**Software Requirements Specification**

**for**

**<Emotion Recognition>**

**Version 1.0 approved**

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**Revision History**

* **Introduction**

The Facial Emotion Recognition System is a software application designed to analyse and interpret human facial expressions and accurately identify the underlying emotions. The system will utilize image processing and machine learning techniques to recognize emotions such as happiness, sadness, anger, surprise, fear, and disgust in real-time or from still images.

**1.1 Purpose**

The purpose of this document is to define the software requirements for the Facial Emotion Recognition (FER) system. This document outlines the scope of the system, its intended users, and the features it aims to provide.

**1.2 Document Conventions**

N/A (No specific document conventions are used in this document.)

**1.3 Intended Audience and Reading Suggestions**

This document is intended for developers, designers, project managers, and stakeholders involved in the FER system's development and implementation. It's recommended to read the entire document to gain a comprehensive understanding of the system's requirements.

**1.4 Product Scope**

The FER system is designed to analyse facial images and predict associated emotions accurately. It serves as a tool for users to interpret emotions from facial expressions. This SRS covers the software requirements for the FER system.

**1.5 References**

- [Reference 1]: "Facial Emotion Recognition: A Comprehensive Review" - Journal of Pattern Recognition

**2. Overall Description**

**2.1 Product Perspective**

The FER system is a standalone application that analyses facial images provided by users. It utilizes a trained convolutional neural network (CNN) model to predict emotions from the images. The FER system operates independently without dependencies on other systems.

**2.2 Product Functions**

The major functions of the FER system include:

- Image Preprocessing: The system preprocesses input facial images to ensure uniformity and enhance prediction accuracy.

- Emotion Recognition: Utilizing a trained CNN model, the system predicts emotions present in the pre-processed facial images.

- Results Visualization: The system displays the predicted emotions alongside the original input images.

**2.3 User Classes and Characteristics**

The FER system serves two user classes:

- End-Users: Individuals, such as psychologists, educators, and researchers, who want to understand emotions from facial expressions.

- Administrators: Responsible for system maintenance, updates, and ensuring data privacy.

**2.4 Operating Environment**

- Hardware: Standard personal computers with minimum of 4GB RAM and multi-core processor, such as an Intel Core i5 or equivalent processing power are required to ensure smooth performance.

- Software: The system supports modern operating systems, including but not limited to Windows 10, macOS 10.14+, and Ubuntu 18.04+ with the FER system and required frameworks (e.g., TensorFlow). The system supports widely used web browsers such as Google Chrome, Mozilla Firefox and Microsoft Edge.

**2.5 Design and Implementation Constraints**

- Real-time Processing: The system must process input images and provide predictions within a reasonable time frame (not exceeding 2 seconds).

- Model Compatibility: The FER system requires a trained emotion recognition model compatible with the selected deep learning framework (e.g., TensorFlow).

**2.6 User Documentation**

- User Manual: A comprehensive guide for end-users, explaining image upload, result interpretation, and navigation.

- Admin Guide: Instructions for administrators on maintenance tasks, model updates, and system monitoring.

**2.7 Assumptions and Dependencies**

- Assumption 1: Users provide clear, well-illuminated facial images with visible expressions.

- Dependency 1: The FER system relies on a trained CNN model compatible with TensorFlow.

**3. External Interface Requirements**

**3.1 User Interfaces**

The user interface is a web-based application accessible via standard web browsers. It includes:

- Image Upload: Users upload facial images for analysis.

- Results Display: Predicted emotions alongside input images.

**3.2 Hardware Interfaces**

In the current setup no hardware interface is required as we are working with available set of images. However camera can be connected (using USB port) directly and live images can be used. The project is compatible with any image taken from device integrated webcam or external camera.

**3.3 Software Interfaces**

- Web Browser: Users interact with the system using common web browsers (e.g., Chrome, Firefox).

- TensorFlow Library: The FER system utilizes TensorFlow to load the trained CNN model for emotion recognition.

**3.4 Communications Interfaces**

- HTTP/HTTPS: The web application communicates with the server using HTTP/HTTPS protocols for image upload and result retrieval.

**4. System Features**

**4.1 Image Preprocessing**

This feature encompasses several preprocessing steps for input images:

- Resize: Images are resized to a standard dimension (e.g., 48x48 pixels) for consistency.

- Normalize: Pixel values are normalized to [0, 1] for model training and predictions.

- Grayscale Conversion: Images are converted to grayscale for simplified processing.

**4.2 Emotion Recognition**

The system employs a trained CNN model for emotion recognition. The model takes pre-processed facial images as input and produces a probability distribution over emotion classes.

**4.3 Results Visualization**

Predicted emotions are displayed alongside corresponding input images on the user interface. Emotions are presented as textual labels, possibly with associated confidence scores.

**4.4 Emotion Classification**

The model should be able to accurately classify the following emotion classes:

Happiness, Sadness, Anger, Surprise, Fear, Disgust.

**5. Other Nonfunctional Requirements**

**5.1 Performance Requirements**

- Response Time: Predictions provided within 2 seconds after image upload.

- Throughput: The system handles a minimum of 10 requests per minute.

**5.2 Security Requirements**

- Data Privacy: Uploaded images are not stored beyond the analysis process.

- User Authentication: Administrative access is protected by strong user authentication.

**5.3 Usability Requirements**

- Intuitive Interface: The user interface is user-friendly and requires minimal training.

- Error Handling: Clear error messages are displayed for incorrect input or processing errors.

**5.4 Maintainability and Scalability Requirements**

- Model Updates: The system architecture supports easy model updates.

- Scalability: The system is designed to handle increased user load by scaling server resources.

**6. Other Requirements**

**6.1 Future Enhancements**

-Multi-Modal Analysis: Incorporate audio cues for more comprehensive emotion recognition by analyzing speech patterns and intonation.

- Real-time Video Streaming: We can extend real-time processing to live video streaming scenarios, enabling continues emotion analysis.

Appendix A: Glossary

N/A

Appendix B: Use Case Diagrams

- Include detailed use case diagrams illustrating user interactions with the FER system.

Appendix C: References

- [Reference 1]: "Facial Emotion Recognition: A Comprehensive Review" - Journal of Pattern Recognition